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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|-----------------------------|------------------|
| 10/715,237 | 11/17/2003 | Arun Kwangil Iyengar | YOR920030490US1 (163-19) | 5011 |
| 24336 | 7590 | 09/17/2007 | EXAMINER | |
| KEUSEY, TUTUNJIAN & BITETTO, P.C. 20 CROSSWAYS PARK NORTH SUITE 210 WOODBURY, NY 11797 | | | HWANG, JOON H | |
| | | ART UNIT | PAPER NUMBER | |
| | | 2166 | | |
| | | MAIL DATE | DELIVERY MODE | |
| | | 09/17/2007 | PAPER | |

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

| | | |
|------------------------------|---------------------------|------------------|
| Office Action Summary | Application No. | Applicant(s) |
| | 10/715,237 | IYENGAR ET AL. |
| | Examiner Joon H. Hwang | Art Unit 2166 |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 03 July 2007.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-52 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-52 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) Notice of References Cited (PTO-892)
- 2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) Notice of Informal Patent Application
- 6) Other: _____

DETAILED ACTION

1. The applicants amended claims 1 and 20 in the amendment filed on 6/4/07.

The claims 1-52 are pending.

Response to Arguments

2. Applicant's arguments with respect to claims 1-52 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
4. Claims 1, 6-8, 12-14, 16, 20-23, 29-31, 35-37, 39, and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Challenger et al. (U.S. Patent No. 6,567,893) in view of Islam et al. (U.S. Patent No. 6,202,132).

With respect to claim 1, Challenger teaches maintaining consistent copies of the object based on a balance between consistency level and performance to improve system (i.e., consistency of a cached object is based on $L(o)$ representing the expected lifetime, $w(o)$ representing consistency importance, $c(o)$ representing the update cost for consistency, lines 22-58 in col. 6). Challenger does not explicitly disclose a plurality of consistency policies. However, Islam teaches applying a plurality of consistency policies in which application of at least one consistency policy results in different system performance than a second consistency policy (i.e., consistency-action matrix used to

implement a variety of different cache consistency protocols, line 58 in col. 10 thru line 37 in col. 13) in order to improve a cache architecture that enables the implementation of custom-specific and/or item-specific cache-coherency and cache-replacement polices (lines 15-20 in col. 1). Islam also teaches selecting a consistency policy from the plurality of consistency policies for an object, wherein the selection is made to improve system performance (i.e., each cached item can utilize one of different consistency-action matrices for consistency policies, lines 41-43 in col. 5, lines 59-61 in col. 8, line 57 in col. 10 thru line 4 in col. 11, and lines 50-52 in col. 12). Therefore, based on Challenger in view of Islam, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Islam to the system of Challenger in order to improve a cache architecture that enables the implementation of custom-specific and/or item-specific cache-coherency and cache-replacement polices.

With respect to claim 6, Islam teaches managing the plurality of consistency policies using a consistency coordinator (i.e., the consistency-action matrix, fig. 14, line 50 in col. 1 thru line 3 in col. 2, lines 52-64 in col. 3, and line 58 in col. 10 thru line 14 in col. 11).

With respect to claim 7, Islam teaches selecting is performed by an application, which writes the object (abstract and line 50 in col. 1 thru line 3 in col. 2).

With respect to claim 8, Challenger teaches an object has a lifetime (lines 22-58 in col. 6). Islam further teaches switching a consistency policy of the object during the object's lifetime (fig. 14, line 50 in col. 1 thru line 3 in col. 2, lines 52-64 in col. 3, and

line 58 in col. 10 thru line 14 in col. 11). Therefore, the limitations of claim 8 are rejected in the analysis of claim 1 above, and the claim is rejected on that basis.

With respect to claim 12, Islam further teaches choosing a consistency policy for at least one object, which maximizes system performance (i.e., reducing subsequent cache miss, thus reducing communication latency, lines 41-43 in col. 5, lines 59-61 in col. 8, line 57 in col. 10 thru line 4 in col. 11, and lines 50-52 in col. 12). Therefore, the limitations of claim 12 are rejected in the analysis of claim 1 above, and the claim is rejected on that basis.

With respect to claim 13, Challenger teaches system performance is maximized by adjusting at least one of CPU overhead, communication latency and message overhead (i.e., fewer update message, lines 18-48 in col. 7).

With respect to claim 14, Challenger teaches a consistency policy of at least one object is specified as a condition in terms of a temporal or semantic state of the object (lines 22-58 in col. 6).

With respect to claim 16, Challenger teaches one of differentiating and prioritizing communication between a cache and a consistency coordinator by a cache device (lines 59-67 in col. 6).

The limitations of claim 20 are rejected in the analysis of claim 1 above, and the claim is rejected on that basis.

With respect to claim 21, Challenger teaches maintaining consistent copies of the object based on a balance between consistency level and performance to improve system (i.e., consistency of a cached object is based on L(o) representing the expected

lifetime, $w(o)$ representing consistency importance, $c(o)$ representing the update cost for consistency, lines 22-58 in col. 6). Challenger does not explicitly disclose a plurality of consistency policies. However, Islam teaches maintaining consistency using a plurality of consistency policies in which at least one consistency policy achieves stronger consistency results than a second consistency policy (fig. 1a, line 50 in col. 1 thru line 3 in col. 2, lines 52-64 in col. 3, and line 58 in col. 10 thru line 37 in col. 13) in order to improve a cache architecture that enables the implementation of custom-specific and/or item-specific cache-coherency and cache-replacement polices (lines 15-20 in col. 1). Islam further teaches selectively choosing a consistency policy for at least one object (i.e., each cached item can utilize one of different consistency-action matrices for consistency policies, lines 41-43 in col. 5, lines 59-61 in col. 8, line 57 in col. 10 thru line 4 in col. 11, and lines 50-52 in col. 12). Therefore, based on Challenger in view of Islam, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Islam to the system of Challenger in order to improve a cache architecture that enables the implementation of custom-specific and/or item-specific cache-coherency and cache-replacement polices.

With respect to claim 22, Challenger teaches adjusting a level of consistency for at least one object in response to consistency overhead (lines 22-58 in col. 6).

With respect to claim 23, Islam further teaches an object managed using one of expiration time, update all, update holders, and deferred invalidation consistency becomes managed using strong consistency (fig. 14, line 50 in col. 1 thru line 3 in col. 2, lines 52-64 in col. 3, lines 51-61 in col. 8, and line 58 in col. 10 thru line 14 in col. 11).

Therefore, the limitations of claim 23 are rejected in the analysis of claim 21 above, and the claim is rejected on that basis.

With respect to claim 29, Islam teaches managing the plurality of consistency policies using a consistency coordinator (i.e., the consistency-action matrix, fig. 14, line 50 in col. 1 thru line 3 in col. 2, lines 52-64 in col. 3, and line 58 in col. 10 thru line 14 in col. 11).

With respect to claim 30, Islam teaches selecting is performed by an application, which writes the object (abstract and line 50 in col. 1 thru line 3 in col. 2).

With respect to claim 31, Challenger teaches an object has a lifetime (lines 22-58 in col. 6). Islam further teaches switching a consistency policy of the object during the object's lifetime (fig. 14, line 50 in col. 1 thru line 3 in col. 2, lines 52-64 in col. 3, and line 58 in col. 10 thru line 14 in col. 11). Therefore, the limitations of claim 8 are rejected in the analysis of claim 1 above, and the claim is rejected on that basis.

With respect to claim 35, Islam further teaches choosing a consistency policy for at least one object, which maximizes system performance (i.e., reducing subsequent cache miss, thus reducing communication latency, lines 41-43 in col. 5, lines 59-61 in col. 8, line 57 in col. 10 thru line 4 in col. 11, and lines 50-52 in col. 12). Therefore, the limitations of claim 35 are rejected in the analysis of claim 21 above, and the claim is rejected on that basis.

With respect to claim 36, Challenger teaches system performance is maximized by adjusting at least one of CPU overhead, communication latency and message overhead (i.e., fewer update message, lines 18-48 in col. 7).

With respect to claim 37, Challenger teaches a consistency policy of at least one object is specified as a condition in terms of a temporal or semantic state of the object (lines 22-58 in col. 6).

With respect to claim 39, Challenger teaches one of differentiating and prioritizing communication between a cache and a consistency coordinator by a cache device (lines 59-67 in col. 6).

The limitations of claim 43 are rejected in the analysis of claim 21 above, and the claim is rejected on that basis.

5. Claims 2-3 and 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Challenger et al. (U.S. Patent No. 6,567,893) in view of Islam et al. (U.S. Patent No. 6,202,132), and further in view of Stenstrom ("A Cache Consistency Protocol for Multiprocessors with Multistage Networks", ACM, 1989, pages 407-415).

With respect to claim 2, Challenger and Islam disclose the claimed subject matter as discussed above except an update-all consistency policy and an update-holders consistency policy. However, Stenstrom teaches at least one consistency policy includes an update-all consistency policy (i.e., updates to all cache, "1. Introduction" on pages 407-408) and the second consistency policy includes an update-holders consistency policy (i.e., updates to caches that have a copy of data object, "1. Introduction" on pages 407-408 and "2.2 Protocol Behavior" on pages 409-410) in order to provide selections for minimizing communication cost. Therefore, based on Challenger in view of Islam, and further in view of Stenstrom, it would have been

obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Stenstrom to the system of Challenger in order to provide selections for minimizing communication cost.

With respect to claim 3, Challenger and Islam disclose the claimed subject matter as discussed above except a coordinate-all consistency policy and a coordinate-holders consistency. However, Stenstrom teaches at least one consistency policy includes a coordinate-all consistency policy (i.e., updates to all cache, "1. Introduction" on pages 407-408) and the second consistency policy includes a coordinate-holders consistency (i.e., updates to caches that have a copy of data object, "1. Introduction" on pages 407-408 and "2.2 Protocol Behavior" on pages 409-410) in order to provide selections for minimizing communication cost. Therefore, based on Challenger in view of Islam, and further in view of Stenstrom, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Stenstrom to the system of Challenger in order to provide selections for minimizing communication cost.

With respect to claim 24, Challenger and Islam disclose the claimed subject matter as discussed above except one of update all, update holders, and deferred invalidation consistency. However, Stenstrom teaches one of update all, update holders, and deferred invalidation consistency ("1. Introduction" on pages 407-408 and "2.2 Protocol Behavior" on pages 409-410) in order to provide selections for minimizing communication cost. Therefore, based on Challenger in view of Islam, and further in view of Stenstrom, it would have been obvious to one having ordinary skill in the art at

the time the invention was made to utilize the teaching of Stenstrom to the system of Challenger in order to provide selections for minimizing communication cost.

With respect to claim 25, Challenger and Islam disclose the claimed subject matter as discussed above except an update-all consistency policy and an update-holders consistency policy. However, Stenstrom teaches at least one consistency policy includes an update-all consistency policy (i.e., updates to all cache, "1. Introduction" on pages 407-408) and the second consistency policy includes an update-holders consistency policy (i.e., updates to caches that have a copy of data object, "1. Introduction" on pages 407-408 and "2.2 Protocol Behavior" on pages 409-410) in order to provide selections for minimizing communication cost. Therefore, based on Challenger in view of Islam, and further in view of Stenstrom, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Stenstrom to the system of Challenger in order to provide selections for minimizing communication cost.

With respect to claim 26, Challenger and Islam disclose the claimed subject matter as discussed above except a coordinate-all consistency policy and a coordinate-holders consistency. However, Stenstrom teaches at least one consistency policy includes a coordinate-all consistency policy (i.e., updates to all cache, "1. Introduction" on pages 407-408) and the second consistency policy includes a coordinate-holders consistency (i.e., updates to caches that have a copy of data object, "1. Introduction" on pages 407-408 and "2.2 Protocol Behavior" on pages 409-410) in order to provide selections for minimizing communication cost. Therefore, based on Challenger in view

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of Islam, and further in view of Stenstrom, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Stenstrom to the system of Challenger in order to provide selections for minimizing communication cost.

6. Claims 4-5, 15, 27-28, and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Challenger et al. (U.S. Patent No. 6,567,893) in view of Islam et al. (U.S. Patent No. 6,202,132), and further in view of Krishnamurthy et al. (U.S. Publication No. 2003/0061272).

With respect to claim 4, Challenger and Islam disclose the claimed subject matter as discussed above except strong and weak consistency policies. However, Krishnamurthy teaches strong and weak consistency policies (sections 9-10 on page 1) in order to provide appropriate and optimal selections for cache consistency. Therefore, based on Challenger in view of Islam, and further in view of Krishnamurthy, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Krishnamurthy to the system of Challenger in order to provide appropriate and optimal selections for cache consistency.

With respect to claim 5, Challenger and Islam disclose the claimed subject matter as discussed above. Islam further teaches one consistency policy under at least one condition and another consistency policy if the at least one condition is not met (lines 52-64 in col. 3 and line 58 in col. 10 thru line 14 in col. 11). Challenger and Islam do not explicitly disclose a strong consistency and a weak consistency. However, Krishnamurthy teaches strong and weak consistency policies (sections 9-10 on page 1)

in order to provide appropriate and optimal selections for cache consistency. Therefore, based on Challenger in view of Islam, and further in view of Krishnamurthy, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Krishnamurthy to the system of Challenger in order to provide appropriate and optimal selections for cache consistency.

With respect to claim 15, Challenger and Islam disclose the claimed subject matter as discussed above except at least one of always strong consistency, conditional strong consistency, weak consistency with guarantees, and weak consistency. However, Krishnamurthy teaches at least one of always strong consistency, conditional strong consistency, weak consistency with guarantees, and weak consistency (i.e., weak consistency, sections 9-10 on page 1) in order to provide appropriate and optimal selections for cache consistency. Therefore, based on Challenger in view of Islam, and further in view of Krishnamurthy, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Krishnamurthy to the system of Challenger in order to provide appropriate and optimal selections for cache consistency.

With respect to claim 27, Challenger and Islam disclose the claimed subject matter as discussed above except strong and weak consistency policies. However, Krishnamurthy teaches strong and weak consistency policies (sections 9-10 on page 1) in order to provide appropriate and optimal selections for cache consistency. Therefore, based on Challenger in view of Islam, and further in view of Krishnamurthy, it would have been obvious to one having ordinary skill in the art at the time the invention was

made to utilize the teaching of Krishnamurthy to the system of Challenger in order to provide appropriate and optimal selections for cache consistency.

With respect to claim 28, Challenger and Islam disclose the claimed subject matter as discussed above. Islam further teaches one consistency policy under at least one condition and another consistency policy if the at least one condition is not met (lines 52-64 in col. 3 and line 58 in col. 10 thru line 14 in col. 11). Challenger and Islam do not explicitly disclose a strong consistency and a weak consistency. However, Krishnamurthy teaches strong and weak consistency policies (sections 9-10 on page 1) in order to provide appropriate and optimal selections for cache consistency. Therefore, based on Challenger in view of Islam, and further in view of Krishnamurthy, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Krishnamurthy to the system of Challenger in order to provide appropriate and optimal selections for cache consistency.

With respect to claim 38, Challenger and Islam disclose the claimed subject matter as discussed above except at least one of always strong consistency, conditional strong consistency, weak consistency with guarantees, and weak consistency. However, Krishnamurthy teaches at least one of always strong consistency, conditional strong consistency, weak consistency with guarantees, and weak consistency (i.e., weak consistency, sections 9-10 on page 1) in order to provide appropriate and optimal selections for cache consistency. Therefore, based on Challenger in view of Islam, and further in view of Krishnamurthy, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Krishnamurthy to

the system of Challenger in order to provide appropriate and optimal selections for cache consistency.

7. Claims 9 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Challenger et al. (U.S. Patent No. 6,567,893) in view of Islam et al. (U.S. Patent No. 6,202,132), and further in view of Iyengar et al. (U.S. Publication No. 2003/0172236).

With respect to claim 9, Challenger and Islam disclose the claimed subject matter as discussed above. Challenger teaches a consistency coordinator, which manages a consistency policy (i.e., a server controlling an update, lines 25-34 in col. 4 and lines 22-58 in col. 6). Challenger and Islam do not explicitly disclose measuring activity of a consistency coordinator. However, Iyengar teaches measuring activity of a cache coordinator, which manages cache policies in the system and maintaining connections with caches in the system in accordance with the activity of the consistency coordinator (abstract, fig. 1, fig. 3, sections 40 and 45) in order to reduce overhead and/or latency associated with updating operations (section 22). Therefore, based on Challenger in view of Islam, and further in view of Iyengar, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Iyengar to the system of Challenger in order to reduce overhead and/or latency associated with updating operations.

With respect to claim 32, Challenger and Islam disclose the claimed subject matter as discussed above. Challenger teaches a consistency coordinator, which manages a consistency policy (i.e., a server controlling an update, lines 25-34 in col. 4

and lines 22-58 in col. 6). Challenger and Islam do not explicitly disclose measuring activity of a consistency coordinator. However, Iyengar teaches measuring activity of a cache coordinator, which manages cache policies in the system and maintaining connections with caches in the system in accordance with the activity of the consistency coordinator (abstract, fig. 1, fig. 3, sections 40 and 45) in order to reduce overhead and/or latency associated with updating operations (section 22). Therefore, based on Challenger in view of Islam, and further in view of Iyengar, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Iyengar to the system of Challenger in order to reduce overhead and/or latency associated with updating operations.

8. Claims 10-11 and 33-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Challenger et al. (U.S. Patent No. 6,567,893) in view of Islam et al. (U.S. Patent No. 6,202,132) and Iyengar et al. (U.S. Publication No. 2003/0172236), and further in view of Lowery et al. (U.S. Publication No. 2002/0107935).

With respect to claims 10-11, Challenger, Islam, and Iyengar disclose the claimed subject matter as discussed above except communicating the activity of the consistency coordinator comprises sending heartbeat messages to the caches. However, Lowery teaches communicating the activity of a cache coordinator comprises sending heartbeat messages to the caches (i.e., heartbeat among master cache module and member cache modules, fig. 6, section 30 on page 3, sections 109 and 113 on page 11, and section 133 on page 14) in order to indicate an active state. Therefore,

based on Challenger in view of Islam and Iyengar, and further in view of Lowery, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Lowery to the system of Challenger in order to indicate an active state.

With respect to claims 33-34, Challenger, Islam, and Iyengar disclose the claimed subject matter as discussed above except communicating the activity of the consistency coordinator comprises sending heartbeat messages to the caches. However, Lowery teaches communicating the activity of a cache coordinator comprises sending heartbeat messages to the caches (i.e., heartbeat among master cache module and member cache modules, fig. 6; section 30 on page 3, sections 109 and 113 on page 11, and section 133 on page 14) in order to indicate an active state. Therefore, based on Challenger in view of Islam and Iyengar, and further in view of Lowery, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Lowery to the system of Challenger in order to indicate an active state.

9. Claims 17-19, 40-42, 44, and 49-50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Challenger et al. (U.S. Patent No. 6,567,893) in view of Islam et al. (U.S. Patent No. 6,202,132), and further in view of Mehrotra et al. (U.S. Patent No. 6,145,054).

With respect to claim 17, Challenger and Islam disclose the claimed subject matter as discussed above except maintaining at least two queues in the cache.

However, Mehrotra teaches maintaining at least two queues in the cache to hold messages communicated to the cache device (fig. 3, fig. 7, lines 47-65 in col. 3, line 47 in col. 9 thru line 6 in col. 10, and line 17 in col. 14 thru line 13 in col. 15) in order to improve the performance of the cache memory system. Therefore, based on Challenger in view of Islam, and further in view of Mehrotra, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Mehrotra to the system of Challenger in order to improve the performance of the cache memory system.

With respect to claim 18, Mehrotra further teaches prioritizing messages in one queue with a higher priority than messages in another queue (fig. 3, fig. 7, lines 47-65 in col. 3, line 47 in col. 9 thru line 6 in col. 10, and line 17 in col. 14 thru line 13 in col. 15). Therefore, the limitations of claim 18 are rejected in the analysis of claim 17 above, and the claim is rejected on that basis.

With respect to claim 19, Challenger and Islam disclose the claimed subject matter as discussed above except maintaining a number of connections by a cache which is dynamically varied depending upon a load on the cache device. However, Mehrotra teaches maintaining a number of connections by a cache which is dynamically varied depending upon a load on the cache device (fig. 3, fig. 7, lines 47-65 in col. 3, line 47 in col. 9 thru line 6 in col. 10, and line 17 in col. 14 thru line 13 in col. 15) in order to improve the performance of the cache memory system. Therefore, based on Challenger in view of Islam, and further in view of Mehrotra, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the

teaching of Mehrotra to the system of Challenger in order to improve the performance of the cache memory system.

With respect to claim 40, Challenger and Islam disclose the claimed subject matter as discussed above except maintaining at least two queues in the cache. However, Mehrotra teaches maintaining at least two queues in the cache to hold messages communicated to the cache device (fig. 3, fig. 7, lines 47-65 in col. 3, line 47 in col. 9 thru line 6 in col. 10, and line 17 in col. 14 thru line 13 in col. 15) in order to improve the performance of the cache memory system. Therefore, based on Challenger in view of Islam, and further in view of Mehrotra, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Mehrotra to the system of Challenger in order to improve the performance of the cache memory system.

With respect to claim 41, Mehrotra further teaches prioritizing messages in one queue with a higher priority than messages in another queue (fig. 3, fig. 7, lines 47-65 in col. 3, line 47 in col. 9 thru line 6 in col. 10, and line 17 in col. 14 thru line 13 in col. 15). Therefore, the limitations of claim 41 are rejected in the analysis of claim 40 above, and the claim is rejected on that basis.

With respect to claim 42, Challenger and Islam disclose the claimed subject matter as discussed above except maintaining a number of connections by a cache which is dynamically varied depending upon a load on the cache device. However, Mehrotra teaches maintaining a number of connections by a cache which is dynamically varied depending upon a load on the cache device (fig. 3, fig. 7, lines 47-65 in col. 3,

line 47 in col. 9 thru line 6 in col. 10, and line 17 in col. 14 thru line 13 in col. 15) in order to improve the performance of the cache memory system. Therefore, based on Challenger in view of Islam, and further in view of Mehrotra, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Mehrotra to the system of Challenger in order to improve the performance of the cache memory system.

With respect to claim 44, Challenger teaches a plurality of caches for storing objects (i.e., 12a in fig. 1). Challenger teaches a cache comprising a queue, which designates an update priority of an object included in the queue (lines 59-67 in col. 6). Challenger teaches a coordination coordinator having selective communication with the caches, which manages requests for updates from the caches in accordance with the queue priority (i.e., a server 14 in fig. 1, lines 59-67 in col. 6, and lines 26-34 in col. 4). Challenger does not explicitly disclose a plurality of consistency policies. However, Islam teaches a plurality of consistency policies maintained throughout the system such that at least one consistency policy results in different performance than a second consistency policy (i.e., consistency-action matrix used to implement a variety of different cache consistency protocols, line 58 in col. 10 thru line 37 in col. 13) in order to improve a cache architecture that enables the implementation of custom-specific and/or item-specific cache-coherency and cache-replacement polices (lines 15-20 in col. 1). Therefore, based on Challenger in view of Islam, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Islam to the system of Challenger in order to improve a cache architecture that

enables the implementation of custom-specific and/or item-specific cache-coherency and cache-replacement polices. Challenger and Islam do not explicitly disclose each cache comprising at least two queues. However, Mehrotra teaches each cache comprising at least two queues, which designate an update priority of the object included in each queue (fig. 3, fig. 7, lines 47-65 in col. 3, line 47 in col. 9 thru line 6 in col. 10, and line 17 in col. 14 thru line 13 in col. 15) in order to improve the performance of the cache memory system. Therefore, based on Challenger in view of Islam, and further in view of Mehrotra, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Mehrotra to the system of Challenger in order to improve the performance of the cache memory system.

With respect to claim 49, Islam further teaches an application, which writes the object, for selecting the consistency policy for an object (abstract and line 50 in col. 1 thru line 3 in col. 2). Therefore, the limitations of claim 49 are rejected in the analysis of claim 44 above, and the claim is rejected on that basis.

With respect to claim 50, Mehrotra further teaches a number of connections between the coordinator and the caches wherein the number is adjusted in accordance with activity of the coordinator (fig. 3, fig. 7, lines 47-65 in col. 3, line 47 in col. 9 thru line 6 in col. 10, and line 17 in col. 14 thru line 13 in col. 15). Therefore, the limitations of claim 50 are rejected in the analysis of claim 44 above, and the claim is rejected on that basis.

10. Claims 45-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Challenger et al. (U.S. Patent No. 6,567,893) in view of Islam et al. (U.S. Patent No. 6,202,132) and Mehrotra et al. (U.S. Patent No. 6,145,054), and further in view of Stenstrom ("A Cache Consistency Protocol for Multiprocessors with Multistage Networks", ACM, 1989, pages 407-415).

With respect to claim 45, Challenger, Islam and Mehrotra disclose the claimed subject matter as discussed above except an update-all consistency policy and an update-holders consistency policy. However, Stenstrom teaches at least one consistency policy includes an update-all consistency policy (i.e., updates to all cache, "1. Introduction" on pages 407-408) and the second consistency policy includes an update-holders consistency policy (i.e., updates to caches that have a copy of data object, "1. Introduction" on pages 407-408 and "2.2 Protocol Behavior" on pages 409-410) in order to provide selections for minimizing communication cost. Therefore, based on Challenger in view of Islam and Mehrotra, and further in view of Stenstrom, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Stenstrom to the system of Challenger in order to provide selections for minimizing communication cost.

With respect to claim 46, Challenger, Islam and Mehrotra disclose the claimed subject matter as discussed above except a coordinate-all consistency policy and a coordinate-holders consistency. However, Stenstrom teaches at least one consistency policy includes a coordinate-all consistency policy (i.e., updates to all cache, "1. Introduction" on pages 407-408) and the second consistency policy includes a

coordinate-holders consistency (i.e., updates to caches that have a copy of data object, "1. Introduction" on pages 407-408 and "2.2 Protocol Behavior" on pages 409-410) in order to provide selections for minimizing communication cost. Therefore, based on Challenger in view of Islam and Mehrotra, and further in view of Stenstrom, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Stenstrom to the system of Challenger in order to provide selections for minimizing communication cost.

11. Claims 47-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Challenger et al. (U.S. Patent No. 6,567,893) in view of Islam et al. (U.S. Patent No. 6,202,132) and Mehrotra et al. (U.S. Patent No. 6,145,054), and further in view of Krishnamurthy et al. (U.S. Publication No. 2003/0061272).

With respect to claim 47, Challenger, Islam and Mehrotra disclose the claimed subject matter as discussed above except strong and weak consistency policies. However, Krishnamurthy teaches strong and weak consistency policies (sections 9-10 on page 1) in order to provide appropriate and optimal selections for cache consistency. Therefore, based on Challenger in view of Islam and Mehrotra, and further in view of Krishnamurthy, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Krishnamurthy to the system of Challenger in order to provide appropriate and optimal selections for cache consistency.

With respect to claim 48, Challenger, Islam and Mehrotra disclose the claimed subject matter as discussed above. Islam further teaches one consistency policy under

at least one condition and another consistency policy if the at least one condition is not met (lines 52-64 in col. 3 and line 58 in col. 10 thru line 14 in col. 11). Challenger, Islam and Mehrotra do not explicitly disclose a strong consistency and a weak consistency. However, Krishnamurthy teaches strong and weak consistency policies (sections 9-10 on page 1) in order to provide appropriate and optimal selections for cache consistency. Therefore, based on Challenger in view of Islam and Mehrotra, and further in view of Krishnamurthy, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Krishnamurthy to the system of Challenger in order to provide appropriate and optimal selections for cache consistency.

12. Claims 51-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Challenger et al. (U.S. Patent No. 6,567,893) in view of Islam et al. (U.S. Patent No. 6,202,132) and Mehrotra et al. (U.S. Patent No. 6,145,054), and further in view of Lowery et al. (U.S. Publication No. 2002/0107935).

With respect to claim 51, Challenger, Islam and Mehrotra disclose the claimed subject matter as discussed above except the activity of the consistency coordinator is communicated to the caches. However, Lowery teaches the activity communication of the coordinator to the cache (i.e., heartbeat among master cache module and member cache modules, fig. 6, section 30 on page 3, sections 109 and 113 on page 11, and section 133 on page 14) in order to indicate an active state. Therefore, based on Challenger in view of Islam and Mehrotra, and further in view of Lowery, it would have been obvious to one having ordinary skill in the art at the time the invention was made

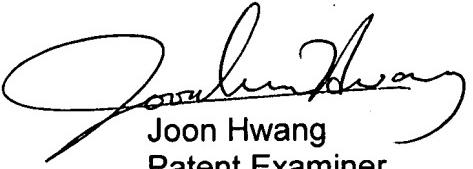
to utilize the teaching of Lowery to the system of Challenger in order to indicate an active state.

With respect to claim 52, Challenger, Islam and Mehrotra disclose the claimed subject matter as discussed above except heartbeat messages. However, Lowery teaches heartbeat messages between the cache and the cache managing element (i.e., heartbeat among master cache module and member cache modules, fig. 6, section 30 on page 3, sections 109 and 113 on page 11, and section 133 on page 14) in order to indicate an active state. Therefore, based on Challenger in view of Islam and Mehrotra, and further in view of Lowery, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the teaching of Lowery to the system of Challenger in order to indicate an active state.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joon H. Hwang whose telephone number is 571-272-4036. The examiner can normally be reached on 9:30-6:00(M~F).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hosain T. Alam can be reached on 571-272-3978. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Joon Hwang
Patent Examiner
Technology Center 2100

9/14/07